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OF CLEAN VERSION OF THE SPECIFICATION,
CLAIMS AND ABSTRACT IF IT WILL ASSIST
THE EXAMINER IN READING THE EXTENSIVE
AMENDMENTS TO THE SPECIFICATION

NEW CHEMICAL SPECIES OF CLUSTERS

RELATED APPLICATIONS

The present application is a continuation-in-part application of pending U.S. patent application Ser. No. 09/586,926 filed on June 5, 2000, which in turn is a continuation-in-part application of pending U.S. patent application Ser. No. 09/372,278 filed on August 11, 1999, which is a continuation-in-part of pending U.S. patent application Ser. No. 09/133,348 filed on August 13, 1998, which in turn is a continuation-in-part application of pending U.S. patent application Ser. No. 09/106,170 filed on June 29, 1998, which in turn is continuation-in-part application of abandoned U.S. patent application Ser. No. 08/785,797 filed on January 1, 1997, which is in turn a continuation application of abandoned U.S. patent application Ser. No. 08/254,377 filed on June 6, 1994; the present application is a continuation-in-part of pending U.S. patent application Ser. No. 09/133,348 filed on August 13, 1998, which in turn is a continuation-in-part application of pending U.S. patent application Ser. No. 09/106,170 filed on June 29, 1998, which in turn is continuation-in-part application of abandoned U.S. patent application Ser. No. 08/785,797 filed on January 1, 1997, which is in turn a continuation application of abandoned U.S. patent application Ser. No. 08/254,377 filed on June 6, 1994; and the present application is a continuation-in-part application of pending U.S. patent application Ser. No. 09/106,170 filed on June 29, 1998, which in turn is continuation-in-part application of abandoned U.S. patent application Ser. No. 08/785,797 filed on January 1, 1997, which is in turn a continuation application of abandoned U.S. patent application Ser. No. 08/254,377 filed on June 6, 1994.

BACKGROUND OF THE INVENTION

1. Field of the invention.

This invention relates, generally, to a novel chemical species, which is composed of clusters and is stable under normal temperature and pressure conditions.

2. Description of the related art.

The only known prior art clusters with a well identified internal attractive bond other than that of a valence type bond consist of molecules under various types of valence bonds.

An additional type of prior art clusters, other than those due to valence bonds, is given by ionic clusters. However, these ionic clusters do not possess a well identified attractive internal bond, and thus have no industrial or practical value because their constituents are ionized molecules, which all have the same positive charge, thus resulting in repulsive internal forces, rather than the attractive bonds needed for the actual production of the stable clusters of the present invention.

The exposure of a gas at atmospheric pressure to an electric arc may also create clusters. They are generated, however, in such small numbers as to be undetectable. Accordingly, these clusters have no industrial or consumer value such as those that may be created by the arc disclosed in an unrelated invention described in U.S. Patent No. 5,487,874 to Gibboney, Jr. Therefore, the exposure of a molecular species of gas to an electric arc leaves the original molecular species mostly unchanged in the sense that the species remains an essentially pure population of conventional molecules. Accordingly, only when a gas is forced to pass at high pressure through a restricted area surrounding an electric arc of a PlasmaArcFlow Reactor of the present invention can a chemical species of clusters be produced in which a chemical species of molecules is turned into an essentially pure population of clusters.

In view of the prior art at the time the present invention was made, it was not obvious to those of ordinary skill in the pertinent art how a new chemical species of stable clusters could be provided with an internal attractive bond other than those due to valence or electric polarization.

SUMMARY OF THE INVENTION

In accordance with the present invention, a substantially pure population of new, stable clusters is provided. These clusters are formed in gas, liquid, or solid compositions and are composed of clusters of two or more of a molecule, a dimer, an atom and combinations thereof in combination with one or more of another molecule, dimer or atom, and any combination thereof. Further, these clusters are detectable by peaks in mass spectrometry, which are not identifiable as any known conventional molecule. In addition, these clusters have no infrared signature at their atomic mass values when formed in gases, no ultraviolet signature when formed in liquids, and no signature for solids other than those signatures of the conventional molecules and dimers constituting the clusters.

These new clusters are formed by forcing a liquid or a gas through an electric arc between at least one pair of carbon-based electrodes. A combustible gas bubbles to the surface of the liquid for collection. The heat generated during the process is absorbed by the liquid and is usable as energy via heat exchangers. Solids precipitate to the bottom of the metal vessel for collection. Under a number of conditions related to kWh, flow and geometry of the electric arc, both the gases and liquids acquire an essentially pure magnecular structure.

Some of the important novel properties of the new clusters include: increased energy density; increased energy output under thermochemical reactions; increased adhesion with other substances; increased penetration within other substances; and other properties which are new

when compared to the corresponding properties of the conventional molecules constituting the clusters and any of their combinations. Consequently, the new chemical species of clusters has new industrial and consumer applications such as fuels for internal combustion engines, fuels for fuel cells, paints, adhesives, as well as, medical and other uses.

This invention accordingly comprises the features and combination of elements in the following description, taken together with the accompanying drawings, and its scope, will be pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

For a fuller understanding of the nature of the invention, reference should be made to the following detailed description, taken in connection with the accompanying drawings, in which:

FIG. 1 is a depiction of the mass spectrometric (MS) peaks of a sample gas composed by the new chemical species;

FIG. 2 is a depiction of the lack of identification of one of the MS peaks of FIG. 1;

FIG. 3 is a depiction of the infrared (IR) spectrum for the entire MS scan of FIG. 1;

FIG. 4 is a depiction of the anomalous IR signature of the conventional CO₂ molecule contained in the gas composed of the present invention;

FIG. 5 is a depiction of the lack of identification of other IR signature of the gas composed of the present invention;

FIG. 6 is a depiction of the anomalous blank of the instrument following the analysis of the gas composed of the present invention;

FIG. 7 is a depiction of another MS scan of the gas composed of the present invention;

FIG. 8 is a depiction of the MS scan of the gas composed of the present invention obtained 30 minutes after the results shown in FIG. 6;

FIG. 9 is a depiction of the lack of identification of the MS peak of FIG. 7;

FIG. 10 is a depiction of a confirmation of the anomalous IR signature of the CO₂ molecule contained in the gas composed of the present invention;

FIG. 11 is a depiction of the background measurement at the end of the tests of FIGS. 7 and 8;

FIG. 12A is a photographic image of the otherwise transparent fragrance oil "ING258IN, Test 2" of this invention;

FIG. 12B is a photographic image of the otherwise transparent fragrance oil "ING258IN, Test 2" of this invention;

FIG. 13A is a photographic image of the initially transparent fragrance oil "Mixture 2" of this invention;

FIG. 13B is a photographic image of the initially transparent fragrance oil "Mixture 2" of this invention;

FIG. 14 shows the TDC scan of magnetically untreated fragrance oil "Mixture 2";

FIG. 15 shows spectroscopic experimental evidence of present invention in treated tap water;

FIG. 16 shows the spectroscopic experimental evidence of present invention in treated 50-50 mixture of tap water and fragrance oil "mixture 2."

FIG. 17 depicts the scan on LC-MS/UVD equipment conducted on the fragrance oil "ING258IN, Test 2" prior to any treatment;

FIG. 18 reproduces the scan using LC-MS/UVD equipment of the polarized oil of "ING258IN, Test 2" with 10% DPG;

FIG. 19 reproduces the scan of the dark liquid at the bottom of the sample tested in FIG. 18;

FIG. 20A depicts a PlasmaArcFlow assembly of the present invention;

FIG. 20B depicts a further embodiment of a PlasmaArcFlow assembly of the present invention;

FIG. 20C depicts yet another embodiment of a PlasmaArcFlow assembly of the present invention; and

FIG. 21 depicts an embodiment of a reactor for the operation of a PlasmaArcFlow assembly.

DETAILED DESCRIPTION OF THE INVENTION

For purposes of the present invention, a chemical species is defined as an essentially pure population of clusters of atoms bonded together by a concrete and specific attractive force, which clusters are stable at ordinary conditions of temperature and pressure and are detectable via peaks under currently available Gas Chromatographic Mass Spectrometers (GC-MS) for gases; InfraRed Detectors (IRD) for gases; Liquid Chromatographic Mass Spectrometers (LC-MS) for liquids; UltraViolet Detectors (UVD) for liquids; and other detection methods for solids, including those based on chemical reactions.

For purposes of the present invention, molecules constitute a chemical species comprising an essentially pure population of atoms that are bonded together by attractive valence forces in their various forms, including attractive forces of co-valence, metallic valence, π -

valence, and other valence type. In fact, molecules are constituted of stable clusters of atoms under an attractive valence bond.

In the case of gases, a given molecule is identifiable by unique and unambiguous GC-MS peaks, which are distinctly different from those of any other gas molecule; this GC-MS identification can be confirmed by IRD peaks and related resonating frequencies, which are also distinctly different from those of any other gas molecule. In addition, identity confirmations are possible using other analytic methods, such as those based on average molecular weight, chemical reactions and other means.

In the case of liquids, a molecule is identifiable by unique and unambiguous peaks in the LC-MS, which peaks are distinctly different from those of any other liquid molecule and can be confirmed via unique peaks and related resonating frequencies in the UVD, which are also distinctly different than those of any other liquid molecule. Additional confirmatory tests may be performed using other analytic methods, such as those based on chemical reactions.

Further, for purposes of the present invention, solids can be essentially assumed to have the same molecules as those found in liquids because obtainable from the latter via a sufficient reduction of temperature. Solid molecules, however, possess reduced intermolecular distances, as well as reduced rotational, vibrational and other motions as compared to the corresponding liquid molecules due to the reduced temperature in the solid state.

As is known in the art, the identity of a molecule can be unambiguously determined by combining two or more of the analytical methods discussed above. It is important to note that the sole use of GC-MS or LC-MS is not sufficient for a scientific determination of the identity of a molecule because a peak that is only identified by GC-MS, for example, could indeed belong to the new chemical species of the present invention and not necessarily belong to that of a

molecule. This is due to the fact that the clusters of the present invention may have the same atomic weight as that of a conventional molecule. In other words, in order to reach a scientific identification of molecules as well as of other clusters, and to differentiate between them, two or more of the analytical methods discussed above must be used in combination, each one verifying the results of the other.

The present invention pertains to gaseous, liquid and solid state substances. The state of the substance depends on external conditions of temperature and pressure, the underlying clusters of a substance, however, remaining essentially the same in all three states.

Atoms, as is known in the art, do not have an IR or UV signature. Further, dimers often have an IR or UV signature that coincides with the IR or UV signature of the related molecule. For example, LC-MS analysis does indeed detect a complete liquid molecule, such as that of water, H₂O, while UVD analysis does not identify the water molecule per se, but only its dimer H-O.

The identification of the new chemical species of the present invention, requires the following three steps: 1) Clusters must be detected as clearly identified peaks in GC-MS scans for gases, LC-MS scans for liquids, and other conventional means for solids. The peaks of the clusters produced by GC-MS scans for gases and LC-MS scans for liquids remain unidentified following a computer search and comparison with all known molecules; 2) The clusters individual peaks which are not identifiable by the MS scan also have no IR signature for gases and no UV signature for liquids at their atomic mass value, other than the signature of its molecular or dimer constituents; and 3) The identification of the clusters is completed and verified by additional experimental evidence, such as measurements of the average density of

clusters which must be greater than that of any molecule contained in the cluster, as well, as any of their combinations.

It must be stressed that, for gases or liquids under conventional conditions, MS scans are generally sufficient for the identification of molecules. Accordingly, the great majority of GC-MS and LC-MG have no IRD or UVD, respectively, and GC-MS equipped with IRD or LC-MS equipped with UVD are instruments generally available in military, governmental or other specialized laboratories. The latter identification is necessary because a peak with a given large atomic weight may appear as being that of a given molecule under the MS scan, while in reality it may have no IR or UV signature at all at its atomic mass value, thus establishing that said large peak cannot possibly be a molecule, since only the hydrogen and very few other light molecules have the perfect sphericity necessary for the absence of an IR signature, while it is physically impossible for large molecules to reach such a perfect spherical symmetry. As a result, scientific measurements which must be used to identify the clusters of this invention are given by GC-MS equipped with IRD, or LC-MS equipped with UVD, where the word equipped is specifically referred to the requirement that both the MS and the IR or UV scans refer to exactly the same range of atomic weight in standard a.m.u. units. In fact, only under the latter condition can a given cluster be jointly analyzed under an MS and an IR or UV scans.

The following terminology applies for purposes of the present invention:

- a. The word atom is used in its conventional meaning as denoting a stable atomic structure, such as oxygen, irrespective of whether the atom is ionized or not and ferromagnetic or not.

b. The word dimer is used to denote part of a molecule, irrespective of whether the dimer is ionized or not, and composed of at least two atoms, such as O-H, C-H, etc., where the symbol "-" denotes a valence bond.

c. The word molecule is used in its internationally known meaning of denoting a stable cluster of atoms bonded by the coupling of the pairs of all available valence electrons, such as H₂, H₂O, C₂H₂, etc., irrespective of whether the molecule is ionized or not, and ferromagnetic or not. Molecules are uniquely and unambiguously identifiable by GC-MS equipped with IRD at the gaseous state, and by LC-MS equipped with UVD at the liquid state.

d. The new chemical species are used to represent clusters of two or more of a molecule, a dimer, an atom and combinations thereof in combination with one or more of another molecule, dimer or atom, and any combination thereof formed by an internal attractive bond. The clusters are stable under normal temperatures and pressures and are identifiable by GC-MS equipped with IRD for the gaseous state or LC-MG equipped with UVD for the liquid state or other means for solids via procedures established below. Due to the bond, clusters have a variable atomic weight depending upon the number of constituent molecules, and/or dimers, and/or atoms. The clusters are identifiable in mass spectrometry by novel peaks, which are unidentifiable by a computer search among all known conventional molecules. Also, the clusters have no infrared signature for gases, no ultraviolet signature for liquids and no other signature for solids except the infrared or ultraviolet signature of the individual molecules or dimers constituting said clusters, for example, H₂, C-O, H-O, etc. The clusters have unique physical and chemical characteristics, including, but not limited to, a unique energy content, a unique density, a unique adhesion to and penetration within other substances, and a unique viscosity, to name a few. All clusters of this invention, including their mass spectrometry peaks and unique physical

and chemical characteristics, disappear at a sufficiently high temperature, such as at the temperature of combustion.

e. The words chemical species are used to denote an essentially pure population of stable clusters, thus implying the conventional chemical species of a molecule and the new chemical species of this invention.

The new chemical species of the present invention comprising of an essentially pure population of clusters, can be industrially created in a form admitting of practical uses for any given substance in the gaseous or liquid state. Clusters at the solid state are created by the solidification of liquid clusters due to a reduction in temperature. As an illustrative example, consider the simplest possible gaseous chemical species, that composed of a conventional hydrogen molecule $H_2 = H-H$.

As reviewed below, the presence of individual unbonded atoms within clusters has been experimentally verified and permits important industrial and consumer applications, such as, the production and use of gaseous compositions composed of an essentially pure population of clusters produced as a by-product in the recycling of liquid waste via a submerged electric arc. This gaseous composition has a unique energy content because, during combustion, it releases about three times the energy expected from the combustion of the conventional molecules constituting the gaseous composition and of any of their combinations. This unique energy release is due to the fact that combustion breaks the clusters, thus releasing isolated atoms and dimers which, at that moment, recombine to form ordinary molecules with a consequential release of a large quantity of energy that is non-existent in fuels having conventional molecular structures.

As a specific example, the atomic composition of the gaseous composition produced via electric arcs submerged within distilled water with one electrode composed by a consumable pure graphite is made of 50% hydrogen atoms, 25% oxygen atoms and 25% carbon atoms, plus other atoms as impurities in parts per millions. In a conventional molecular composition, said H, O and C atoms would combine into conventional molecules. Since the affinity between carbon and oxygen is much greater than that between oxygen and hydrogen, the first molecular formation is that of CO, the second being that of H₂, with traces of O₂, H₂O and CO₂. Therefore, the conventional chemical composition of a gas produced by an electric arc submerged within distilled water with one consumable graphite electrode is essentially given by 50% H₂ and 50% CO plus low levels of H₂O, CO₂ and O₂. Note that no light or heavy hydrocarbon can be admitted since the local temperature of a submerged electric arc is on the order of 10,000°C, at which temperature no hydrocarbon can possibly survive, assuming that it can be formed.

It is well known that the energy content of said 50-50 combination of conventional molecules H₂ and CO is 315 BTU/cf. By comparison, various measurements have established that the energy content of the gaseous composition with the same atomic constituents is about 950 BTU/cf, namely, about three times the predicted value. The excess energy content produced from water and carbon electrodes has been proven beyond doubt by the inventor by converting a 1998 Honda Civic originally produced to run on compressed natural gas with its well known energy content of 1,050 BTU/cf. The compressed natural gas was removed from the vehicle and replaced with the compressed gaseous composition, resulting in a performance, measured in a dynamometer, that was essentially equivalent to that of compressed natural gas. The excess energy release of 635 BTU/cf is due to the combination of the following three properties of the new chemical species of this invention:

1) Analytic tests on the new gaseous composition via infrared detectors or gas chromatograph have established that only approximately 70% of the H, C and O atoms in the above identified new gaseous composition are bonded into H_2 and CO, while the remaining 30% of atoms are trapped uncoupled inside the clusters constituting the new gaseous composition. At the time of the combustion, the clusters break down, by therefore releasing said isolated atoms, which are then in condition to combine into said H_2 and CO molecules. Both of these reactions are highly exoenergetic. In fact, the formation of H_2 releases about 110 Kcal/mole while the formation of CO releases about 255 Kcal/mole. It is therefore evident that the formation of conventional molecules H_2 and CO at the time of breakdown of the clusters caused by combustion provides a first contribution to the indicated excess energy release of 635 BTU/cf. In turn, such a contribution crucially depends on the existence of yet to be bonded isolated atoms in the clusters, the existence of which is experimentally verified as shown below.

2) Once all clusters have been eliminated, and the new gas composition is reduced to its conventional molecular composition, combustion of the new gas composition with atmospheric oxygen occurs according to conventional chemical reactions. Following various measurements, such a combustion produces an exhaust composed of about 50% H_2O , 15% O_2 , 5% CO_2 , the rest being composed of nitrogen and other atmospheric gases.

3) A third new contribution to the excess energy content of the new gas composition is due to the creation of new bonds in the interior of conventional molecules. Consider, as an example, the conventional molecule CO with the usual double valence bonds for which it can be written $C=O$. The infrared signature of $C=O$ shows two peaks which, as is well known, represent the two valence bonds of the considered molecule. It is also well known that each internal bond represents an internal storage of energy which can participate in ordinary

exothermical reactions, such as $\text{CO} + \text{O} \rightarrow \text{CO}_2$. Experimental evidence, as discussed in further detail below, has established that the molecule $\text{C}=\text{O}$ can create a new internal bond which is established by the existence of a new peak in its infrared signature. The new gas composition produced via the above indicated submerged electric arc in distilled water, has stable detectable clusters all the way to 1,000 a.m.u., while the biggest possible cluster contained in such a light gas should be CO_2 with 44 a.m.u.

This latter feature has also been experimentally verified by measurements of the specific density, which is greater than that of any combination of conventional molecular constituents. In turn, the increased density not only confirms the presence of clusters, but also has important industrial and consumer applications. For instance, combustible fuels according to this invention, not only have an energy release which is a multiple of the corresponding energy release for an ordinary molecular structure, but also the duration of use of a given volume at a given pressure of the fuel is a multiple of that of the same volume with the same fuel which only possess a conventional molecular structure.

In the case of liquids, molecules do not generally rotate on their center of gravity due to the intermolecular bonds existing within liquids. Accordingly, the new clusters of this invention are more readily created in liquids than in gases. Moreover, the average atomic weight of the clusters is larger than the average atomic weight of the individual molecular constituents and that of any of their possible combinations. This increased atomic weight, when combined with the increased energy output for thermochemical reactions, has important industrial and consumer applications.

As it is well known, the alarming environmental problems caused by gasoline combustion is stimulating the use of hydrogen as a fuel for internal combustion engines whose exhaust, as

well known, is solely composed of water vapor. Despite that, hydrogen has the following serious environmental problems for automotive usage:

1) Hydrogen has the lowest energy content among all possible fuels, consisting of about 300 BTU/cf. Therefore, in its compressed form, hydrogen does not permit a sufficient duration of automotive use per each tank. For this reason, as proved by a car manufacturer BMW, Munich, Germany, and other automakers, the use of hydrogen as an automotive fuel requires its liquefaction, with consequential prohibitive safety problems in case of change of state, prohibitive costs as well as prohibitive logistic and technical problems for the liquefaction of hydrogen, delivering hydrogen in a liquefied state, and maintaining such a liquefied status in an automotive tank for an unspecified duration of time.

2) Hydrogen implies a reduction in power of about 35% as compared to the power, which can be obtained from the same engine when operating on gasoline. This occurrence has also been proved by the indicated BMW automobile which, when using gasoline, has about 340 HP, while it has only 220 HP when burning hydrogen.

3) Even though the combustion of hydrogen only emits water vapor, hydrogen has other serious environmental problems. In fact, the combustion of hydrogen causes an alarming removal of breathable oxygen from our atmosphere, a very serious environmental problem called "oxygen depletion." When hydrogen is produced via the electrolytic separation of water, the oxygen balance in our atmosphere between the production of hydrogen and its subsequent combustion evidently remains unchanged if the produced oxygen is released free in the atmosphere. However, when the electricity used for the separation of water originates from plants that generate a large amount of pollution, CO₂ emission and oxygen depletion, such as electric plants burning fossil fuels, the use of hydrogen as an automotive fuel becomes much

more damaging to the environment on a global scale than the use of gasoline, for the evident reason that the production of gasoline is done via catalytic processes which do not require large amounts of electricity, while the exhaust of a contemporary car burning gasoline is dramatically less polluting on a global environmental basis than the automotive use of hydrogen produced via electricity originating from power plants burning fossil fuels.

As verified by the conversion of one Ferrari and two Honda automobiles, the new chemical species of this invention resolves all the above major problems.

To begin, the conversion of a conventional hydrogen gas into one of this invention permits the achievement of an increased energy density sufficient for an acceptable duration of automotive use with one tank of compressed gas, thus avoiding the expensive and dangerous liquefaction currently required for hydrogen. As an illustration, a Honda Civic has a range of about 2.5 hours when operating with one thousand cubic feet of the new gas compressed at about 3,600 psi, with range of the order of four hours for the use of a tank of the same size as the preceding one, but operating at 4,500 psi. These automotive ranges are amply sufficient for local commuting usage.

Second, as verified by a Ferrari 1980 model GTSi converted to operate on the new gas, the increased energy output under thermochemical reactions permits the achievement of a performance with the compressed gas which is equivalent to that achieved with gasoline. This second important property has been verified by numerous tests performed at the Moroso International Track in West Palm Beach, Florida, via the indicated Ferrari 308 GTSi 1980 converted to operate on the compressed gas and compared to similar cars operating on gasoline.

Third, conventional hydrogen gas cannot contain any appreciable percentage of oxygen to avoid possible self-combustion with consequential explosions. As a result, the automotive

combustion of hydrogen can only be done via the depletion of breathable oxygen from our atmosphere. On the contrary, an essentially pure population of the new clusters of this invention primarily composed by hydrogen can indeed contain an appreciable percentage of oxygen without risk of self-combustion or explosions due to the stability of the clusters, thus reducing the depletion of breathable oxygen from our atmosphere. As an illustration, the above described converted automobiles operating on the compressed gas, contain in the exhaust up to 14% of breathable oxygen, thus being the only known combustion exhaust capable of sustaining life. It should be noted that the oxygen content in the gas does not originate from our atmosphere, but rather from the liquid waste used in its production, thus replenishing in this way the oxygen content of our atmosphere.

The most efficient device for creating an essentially pure population of the new clusters suitable for industrial or consumer applications is the PlasmaArcFlow Reactor, as described in FIGS. 20A-20C and 21. The PlasmaArcFlow Reactor forces a liquid waste to pass through an underliquid DC electric arc with at least one consumable carbon-based electrode, having, for instance, 1000 amps and 30 volts. With reference to FIGS. 20A-20C and 21, the arc decomposes the liquid molecules and the carbon electrode by creating a plasma of mostly ionized atoms of hydrogen, oxygen, carbon and other elements. The flow of the liquid continuously moves the plasma away from the arc; the plasma cools down in the liquid surrounding the arc; ionized atoms re-acquire their electrons; a number of chemical and other reactions take place; the gas bubbles to the surface of the liquid where it is collected while solids precipitate at the bottom of the liquid where they are periodically collected. In this way a liquid waste is recycled into the clean burning gas of this invention, heat acquired by the liquid, which heat is usable via a heat exchanger, and solids precipitating at the bottom of the reactor where they are collected.

Clusters can also be formed by a variety of other means. For instance, clusters can be produced by electromagnetic fields, which can cause a polarization essentially as in the case of an electric arc. Clusters can also be formed by microwaves. Similarly, clusters can be formed by subjecting a material to a sufficiently high pressure. Clusters can also be formed by friction or by other means not necessarily possessing magnetic or electric fields.

The destruction of the clusters of this invention is achieved by subjecting the essentially pure population of clusters to a temperature greater than the clusters' Curie Temperature, which varies from cluster to cluster.

Clusters have several characteristics that uniquely identify them as a new chemical species, among which we note:

- 1) inability to identify the peaks of clusters in GC-MS analyses via computer searches among all known molecules;
- 2) lack of infrared signature for gases, lack of ultraviolet signature for liquids, and lack of other signatures for solids, except those of the conventional molecules or dimers constituting the clusters;
- 3) average density greater than the average density of all molecular constituents or any of their combinations;
- 4) presence in the clusters of individual unbounded dimers and/or atoms;
- 5) appearance in the infrared signature of the molecules constituting the clusters of new peaks denoting a new internal bond with a consequential new means of storing energy;
- 6) energy released in thermochemical reactions due to the formation of conventional molecules at the time of the break-down of the clusters which is generally a multiple of the energy released by conventional molecular constituents;

- 7) energy produced by conventional exothermic reactions for magnetically polarized molecular constituents of clusters which is also a multiple of the energy released by chemical reactions for unpolarized molecular constituents;
- 8) alteration in time, called mutation, of the MS peaks representing the clusters due to collisions, break down of some of the clusters, and consequential formation of other clusters, or just accretion of smaller clusters or molecules or dimers, or atoms;
- 9) alteration, called mutation, of generally all conventional physical characteristics, such as viscosity, transparency to light, index of refraction, etc.;
- 10) adhesion to walls of containment chambers which is much greater than that of the same unpolarized substance;
- 11) absorption or penetration through other substances which is much greater than those of a conventional gas; and
- 12) termination of all of these unique characteristics at a sufficiently high temperature called Curie Temperature.

Since clusters of this invention have properties very different from those of conventional molecules, the experimental detection of clusters requires special care. In particular, methods which have been conceived and developed for the detection of molecules are not necessarily effective for the detection of the different chemical species of this invention precisely in view of the indicated unique characteristics. For instance, GC-MS equipment, which is very effective for the detection of conventional molecules is basically insufficient for the detection of the new clusters because of the crucial requirement indicated earlier that every peak in the MS should be jointly inspected in the IR, thus requiring the necessary use of GC-MS equipped with IRD.

In addition, numerous other precautions in the use of the GC-MS equipped with IRD are necessary for the detection of the new clusters, such as:

- i) the MS equipment should permit measurements of peaks at ordinary temperature, and avoid the high temperatures of the GC-MS column successfully used for molecules;
- ii) the feeding lines should be cryogenically cooled;
- iii) the GC-MS/IRD should be equipped with feeding lines of at least 0.5 mm ID with larger feeding lines for LC-MS/UVD;
- iv) the GC-MS should be set to detect peaks at atomic weights usually not expected; and
- v) the ramp time should be the longest allowed by the GC-MS/IRD and be of at least 25 minutes.

It should be stressed that the lack of verification of any one of the above conditions generally implies the impossibility to detect the new clusters. For instance, the use of a feeding line with 0.5 mm ID is excessive for a conventional light gas, while it is necessary for the new gas composition discussed above. This is due to the unique adhesion of the clusters against the walls of the feeding line, resulting in an occluded feeding line which prevents the passage of the most important clusters to be detected, those with large atomic weight.

Similarly, it is customary for tests of conventional gases to use GC-MS with columns at high temperature to obtain readings in the shortest possible time, since conventional molecules are perfectly stable under the temperatures here considered. The use of such method would also prevent the detection of the very clusters to be detected because, as indicated earlier, they have a characteristic Curie Temperature varying from case to case at which value all unique

characteristics are terminated. The clusters of this invention are stable at ordinary temperatures and, consequently, they should be measured at ordinary temperatures.

Along similar lines, recall that a GC-MS with a short ramp time is generally used for rapidity of results. Again, the use of such a practice, which has been proven by extensive evidence to be effective for molecules, will prevent clear detection of the new clusters. In fact, if the ramp time is much less than 25 minutes, e.g., it is of the order of one minute, all the peaks of the new clusters generally combine into one single large peak, as verified below. In this case the analyst is generally lead to inspect an individual section of said large peak. However, in so doing, the analyst identifies conventional molecules constituting the new clusters, and not the cluster itself. When these detectors with short ramp times are equipped with IRD, the latter identifies the infrared signatures of individual conventional molecules constituting said large peak, and does not identify the possible IR signature of the single large peak itself. Therefore, a GC-MS with short ramp time is basically unsuited for the detection of the new clusters because it cannot separate all existing peaks into individual peaks, but groups them all together into one single large peak which is unidentifiable as a whole, resulting in the generally erroneous opinion that the chemical composition considered is that of conventional molecules without sufficient scientific evidence.

The test of a gas via a GC-MS and, separately, via an IRD is also grossly misleading and improper. This is due to the well known, general tendency to identify a peak in the MS with a conventional molecule which, at times, may be also present in the separate IRD test, leading to a potentially erroneous conclusion of conventional chemical composition because, as it is well known, IRD do not detect complete molecules, but only their dimers. However, unlike the case for the conventional molecules, dimers can be constituents of the new clusters. Therefore, the

sole identification of a dimer in the IRD not connected to the GC-MS is, by no means, evidence that the corresponding molecule exists in the gas considered.

A typical illustration is given by the detection in a GC-MS without IRD of a peak at 44 a.m.u., which is generally assumed to be CO₂. The separate IR test of the same gas may indeed yield the characteristic signature of carbon dioxide, thus leading to the opinion that the peak here considered is the CO₂. In reality, the IRD has only detected in this case the C-O dimer, while the MS peak at 44 a.m.u. may be due to a new cluster (C-O)_x(H-H)_x(H-H)-C which has indeed atomic weight 44 a.m.u., while admitting indeed the IR signature of CO₂. This ambiguity is due to the fact that, in the case here considered, the IR test is done separately from the MS test. On the contrary, the same ambiguity does not exist for GC-MS equipped with IRD because, in the latter case, the equipment can be restricted to the sole detection of peaks in the vicinity of 44 a.m.u. at both the MS and the IR modes. The lack of MS identification of the peak at 44 a.m.u. in this case establishes beyond doubt that the peak with 44 a.m.u. here considered cannot possibly be a molecule.

Similarly, peaks with 18 a.m.u. are generally associated with the water molecule H-O-H. Such an interpretation may be correct for the case of conventional. However, for the case of the new gas, the interpretation is generally erroneous because the peak at 18 a.m.u. may have no infrared signature when tested with a GC-MS equipped with IRD.

In conclusion, the experimental evidence of the above occurrences, as outlined below, establishes the need in the detection of gas clusters of avoiding, rather than using, techniques and equipment with a proved efficiency for molecules, thus avoiding the use of GC-MS without IRD, with short ramp time, high column temperatures, feeding line with a small section, and other

established techniques. On the contrary, new techniques specifically conceived for the detection of the new clusters should be worked out.

The conditions for scientific measurements of the new clusters in liquids are essentially the same as those for gas clusters, except for the use of LC-MS/UVD, rather than GC-MS/IRD. Liquid clusters possess similar properties and characteristics and require similar detection conditions as those needed for gases, with particular reference to increased size of feeding lines and columns.

The clusters of the present invention are producible by the equipment disclosed in U.S. Patent No. 6,183,604 B1, which is incorporated herein by reference in its entirety. With reference to FIG. 21, the embodiment of the above patent is based on a hollow, cylindrical shaped, carbon based anode rotating edgewise against a stationary tungsten based cathode. Additional means of producing the clusters of the present invention are disclosed herein. With reference to FIGS. 20A, 20B and 20C, a preferred embodiment of the additional means is essentially that of FIG. 21 in which the electrodes are constituted by two carbon based cylindrical rods. More particularly, the flow of the liquid through the arc can indeed occur for the configuration of the electrodes of FIG. 21 or the solid rod shaped electrodes as in the configuration of FIG. 20A. On the contrary, the flow through the arc as in FIGS. 20B and 20C requires a containment of the arc itself described below, which containment is more adequately permitted by the rod shaped electrodes of FIGS. 20B and 20C, as compared to the hollow cylindrical configuration of the cathode of FIG. 21.

In conclusion, the flow of the liquid through the arc, which permits the production of an essentially pure population of the new clusters, as described below can be realized with a variety of electrodes. The first and simplest embodiment is that of FIG. 20A in which the flow occurs

through an unrestricted arc. In this case the arc can be that of the configuration between the electrodes of FIG. 21, or of FIG. 20A, or of other shapes of the electrodes. Other embodiments demand the enclosure of the arc itself within an area specified below. In this case the electrodes of FIG. 21 should be modified into the rod shape forms of FIGS. 20B and 20C, while the rest of the equipment remains unchanged. The latter simple replacement is tacitly implied below whenever needed.

In particular, as shown in FIG. 20A two electrodes 20, 22 of about 3/4" in diameter are immersed within water or a liquid waste to be recycled. The liquid is contained in the interior of a metal vessel, as shown in FIG. 21, surrounding electrodes 20, 22, each consisting of a 1" diameter carbon-based rod. A DC electric arc 95 is made to occur in between the tip 97 of the anode 20 and the tip 98 of the cathode 22, the electrons moving from the negatively charged tip 98 toward the positively charged tip 97, said electric arc 95 being powered by a 75 kWh DC power source (not shown) with a gap 23 designating the distance between the tips 97, 98 of the electrodes 20, 22 which is generally of the order of 1/8" for a 75 kWh DC power source and a related electric arc with 1,500 A and 33 volts.

FIG. 20A also depicts the plasma 96 surrounding the tips 97, 98 of the electrodes 20, 22, which essentially consists of an area having the natural geometry of a spheroidal ellipsoid with semiaxes of about 3/4" x 3/4" x 1"1/2" created by the incandescent character of the tips 97, 98 under the electric arc 95, and generally composed of a mixture of gaseous and liquids components at a temperature the on order of 10,000°C. The recycling of the liquid waste occurs by flowing the liquid via a pump, not shown, forcing the liquid through pipe or tube 24 thus forcing the liquid to pass through the plasma 96 surrounding the tips of the electrodes 20, 22 and through the electric arc 95 with gap 23, and then ending with the outlet flow 25. This

embodiment constitutes the PlasmaArcFlow process, which decomposes the molecules of the liquid to be recycled into gaseous and solid elements. The recombination of the gaseous elements into a combustible gas is controlled by the flow itself, while solids precipitate at the bottom of a reactor where they are periodically collected for industrial and other usages.

A further embodiment is depicted in FIG. 20B, which comprises the same electrodes 20, 22, related tips 97, 98, related gap 23, the electric arc 95 through said gap 23, the plasma 96, and the 75 kWh DC power unit (not shown). The liquid to be recycled is forced to move by a pump, not shown, through tube 24 which ends in a tube 26 of insulating material, such as ceramic, hereinafter called venturi, which has the following main features: 1) the venturi 26 encompasses the tips 97, 98 of the electrodes 20, 22; 2) the venturi 26 has the approximate interior diameter of about 1"1/2" for electrodes with 1" diameters, about 3" in outside diameter, and about 5" in length; 3) the venturi 26 has 1/16" clearance 27 for the electrodes 20, 22 to move freely in and out the venturi 26; 4) the venturi 26 is locked into the tube 24 by fasteners, such as screws 28; and 5) the venturi 26 ends with a smooth curve 29 to minimize turbulences. After being forced to pass through said venturi 26, the liquid waste then exits with outlet flow 25.

The PlasmaArcFlow according to the venturi 26 of FIG. 20B permits the recycling of liquid waste, which attains full sterilization with one single pass when using the venturi 26 of FIG. 20B. In fact, as shown in FIG. 20B the entire liquid sewage is forced to pass through the plasma 96 having 10,000° F, plus an extremely intense light, electric current of 1,500 A and more, very large electric and magnetic fields, all factors which assure the instantaneous termination of all bacteriological activities. The proportionately larger interior diameters of the venturi 26 are needed for larger electrode diameters; the interior shape of the venturi 26 can have

a variety of geometries, such as an ellipsoidal, rather than a cylindrical, sectional area; and the end shape of the venturi 26 can have a variety of different curves to minimize turbulences.

FIG. 20C depicts a third preferred embodiment of the PlasmaArcFlow equipment for the production of an essentially pure population of the new clusters at both the gaseous and liquid states. This third embodiment consists of a venturi 26 in the shape of a cylinder with 1.250 inches internal diameter, 2 inches exterior diameter and 12 inches in length constructed from an insulating material such as phenolic or ceramic and ending with two flanges on each end for attachment to the rest of the embodiment described below, plus one port for the entrance of a liquid and a second port for the exit of the same. Two carbonaceous electrodes, 20, 22 each of 1 inch in diameter and 24 inches in length, are placed in the interior of venturi 26 in such a manner that: 1) the rods 20, 22 and the venturi 26 have the same cylindrical symmetry axis; 2) there is a 0.125 inches thick empty cylindrical interspace between the carbonaceous rods 20, 22 and the interior of the venturi 26; 3) the rods 20, 22 are sealed at each of the two ends of the venturi 26 so as to avoid escape of the liquid being pumped through; 4) an electrical connection of each of the two electrodes 20, 22 to each polarity of a DC generator with 75 kWh (not shown); and 5) the position of the electric arc is within anywhere of 12 inches in length of the venturi 26.

The assembly is then completed in the reactor of FIG. 21. Any one of the PlasmaArcFlow assemblies of Fig. 20A, 20B and 20C may be placed in the reactor of FIG. 21 ~~27~~, with the inlet and outlet of said venturi 26 being connected to a recirculating pump for the flow of a liquid in the interior of venturi 26, a DC power unit of 75 kWh, automatic means for the initiation and control of the arc, means for the collection of the gas produced in the interior of the reactor, means for the utilization of the heat produced by the reactor as acquired by the liquid, and other components of FIG. 21 identified herein.

The vessel of FIG. 21 is filled up with a liquid, such as ordinary tap water, or a liquid waste, such as automotive antifreeze or oil waste, which liquid is forced by the recirculating pump to pass through the indicated 0.125 inch space in between the carbonaceous rods and the interior wall of the venturi 26 while the DC electric arc is operating. The incandescent tips of the electrodes then decompose some of the liquid molecules, exposing the individual atoms to the extremely high magnetic fields of the electric arc which, for a 75 kWh DC arc can be as high as ten Tesla and more at molecular distance from the electric arc, and create a plasma in the surrounding area of the tips of the electrodes composed of highly polarized atoms of hydrogen, oxygen and carbon as occurring in the other two PlasmaArcFlow embodiments of FIG. 20A and FIG. 20B.

The flow of the liquid through the venturi 26 continuously removes the plasma following its formation, resulting in a combustible gas, which is composed of an essentially pure population of gas clusters. The recirculation of the liquid through the arc for the duration of 1 hour for a 75 kWh DC electric arc and 25 gallons of the recirculating liquid create an essentially pure population of liquid clusters. Much shorter periods of recirculation of the liquid are needed for proportionately larger DC power units. For instance, an essentially pure population of 25 gallons of liquid according to the present invention can be formed in 10 minutes via the venturi 26 of FIG. 20C and 150 kWh DC power unit.

The main difference between the embodiment of FIG. 20C and the preceding two embodiments of Figs. 20A and 20B is that, as shown in FIGS. 20A and 20B the flow of the liquid is perpendicular to the symmetry axis of the carbonaceous rods, while in the embodiment of FIG. 20C the flow of the liquid is parallel to the cylindrical symmetry axis of, as well as

surrounding the exterior of the carbonaceous rods, to provide the production of an essentially pure population of gas and liquid clusters from an electric arc.

The achievement of an essentially pure population of the new clusters by the embodiments of FIGS. 20A-20C and 21 is proven and verified by the spectroscopic data provided herein. Specifically, the peaks detected by the MS scans remain unidentified following a search among all molecules, and the peaks have no infrared or ultraviolet signature, respectively, this confirming the lack of valence bonds as discussed herein.

By comparison, the embodiments of the prior art, such as that according to U.S. Patent No. 5,487,874 (the '874 patent) dealing with an electric arc within the chamber of an internal combustion engine may produce gas clusters. Any gas clusters so produced are present in minute amounts in comparison to conventional molecules present so as not to be detectable by available GC-MS analyzers. More particularly, the clusters, which may be created by such an embodiment, are so small in number that they do not emerge from the background noise of the analyzing instrument. This is due to the dramatic numerical differences between the embodiments of the '874 patent and the present invention. First, the arc of the '874 patent occurs within a gas while it occurs within a liquid in the embodiment of this invention. The transition from liquid to gas provides the transition from unit volume of the liquid to 1,800 units of volume of the gas at atmospheric pressure. The compression in the combustion chamber of an engine results in a ratio of the densities of matter in the embodiment of the '874 patent and the present invention on the order of 1,500. This difference explains the creation of mere traces of the new clusters in the embodiment of the '874 patent and definitely is not an essentially pure population of new clusters.

Moreover, sparks of internal combustion engines are notoriously limited in the amount of electric energy they can use for various reasons related to arcing, safety, etc. In fact, the DC spark in the engine of ordinary cars has about 15,000 V and 100 milliamps, resulting in about 150 W. By comparison, the embodiment of this invention can use up to 75,000 W in the case of 1 inch carbonaceous rods, with virtually unlimited larger values of the electric power for proportionately larger carbonaceous rods. Since the creation of the new clusters is directly dependent on the electric energy, this second dramatic difference in numerical values between the prior art and the present invention further establishes that the prior art can only create traces of the new clusters, while the present invention produces an essentially pure population of the new clusters.

The third and most important numerical difference between the prior art and this invention is due to the fact that the electric arcs of pre-existing embodiments are stationary, and, for the case of the '874 patent pulsating and stationary, while the embodiment of this invention provides the flowing of the plasma through a continuous arc. More specifically, in the '874 patent traces of the new clusters can only be created in the immediate vicinity of the spark itself, because immediately thereafter there is combustion. By contrast, the DC electric arc of the present invention does not cause any combustion, and, therefore, operates continuously. Moreover, the PlasmaArcFlow continuously removes the plasma full of clusters immediately following their creation, thus permitting a continuous creation of the new clusters. Further, the spark in an internal combustion engine has the duration on the order of one nanosecond and the frequency of about 5,000 sparks per minute, while the arc of the present invention is continuous, such a difference provides an efficiency in the production of the new clusters in the present invention which is at least 1,000,000 times that of the '874 patent.

A similar situation exists for liquid clusters. However, as is made clear from the above discussion, the prior art can at best create traces of the new clusters in such small numbers as not to be detectable with available LC-MS/UVD equipment. The present invention provides for the first time an essentially pure population of the new liquid clusters via the embodiments of FIGS. 20A-20C and 21, namely, via the continuous forcing of a liquid through a continuously running electric arc.

All embodiments of the present invention also work for AC electric arcs, although the efficiency in the production of the combustible gas is in this case reduced due to the reversal of the arc itself with a frequency equal to that of the AC current.

As shown in FIG. 21 the PlasmaArcFlow reactor is composed of the following main parts:

MAIN CLOSED VESSEL ASSEMBLY, collectively denoted 40 comprising a vertical steel cylindrical sidewall 31 of about 1" thickness, about 3' external diameter and about 7' height, with base 32 consisting of a steel disk of 2" thickness and 3' and 1" in outside diameter fastened to sidewall 31 via high pressure resistant continuous welding 33, the vessel being additionally completed by the steel flange 34 of 2" thickness and 3' 3" in outside diameter fastened to said sidewall 31 via high pressure resistant continuous welding 33, plus a top 35 composed by a steel disk of 2" in thickness and 3' and 3" in outside diameter, which is fastened into the flange 34 via bolts 36 or other means, gasket 37 assuring the complete sealing of the interior chamber in such a way to sustain high pressure, said closed metal vessel being completely filled with the contaminated liquid waste 38 to be recycled.

ELECTRODES ASSEMBLY, comprising the stationary nonconsumable cathode 62 composed by a tungsten rod of at least 2" in outside diameter and 3" in length, housed in a

copper holder 60 which protrudes below and outside the base of the vessel and it is insulated electrically from the same base by the nonconducting bushing 51, fastened to the base by screws 52, gasket 53 ensuring the complete sealing under pressure of the main vessel, said bushing 51 being made of phenolic or other electric insulator in the shape and dimension so as not to allow any distance less than 1" between the cathode holder 60 and the metal base; plus a consumable anode 70 made of carbon, coal or other conducting material, in the shape of a cylinder having the thickness of 3/4", the radius of one foot, and the height of 3', said cylindrical anode 70 being housed inside a copper cup 99 holding the cylindrical anode 70 with fasteners 100, the assembly of the cylindrical anode 70 and its copper holder 99 terminating in the upper part into a copper rod 101 of 3/4" in diameter and height longer than the consumable length of the cylindrical anode 70, e.g., 4' height, the copper rod 101 passing through a contact assembly 58 for the delivery of the electric current with negative polarity, the negative polarity being delivered by high current electric wires 102 while the electric current with the positive polarity is delivered to the copper holder 60 of the cathode 62 in its part protruding outside and below the base. An alternative selection of the electrodes is given by electrodes composed of cylindrical shape, carbon based, solid rods with 1" outside diameter acting edgewise one against the other as in the configurations of FIGS. 20A, 20B and 20C.

PLASMA-ARC-FLOW ASSEMBLY, can be any one of the assemblies shown in FIGS. 20A, 20B and 20C and may be served by a recirculating pump (not shown). As indicated earlier, whenever using a venturi, the replacement of the electrodes of FIG. 21 with those of FIGS. 20B and 20C is assumed. Otherwise, when using a PlasmaArcFlow on an open arc as in the configuration of FIG. 20A, the electrodes can be those of FIG. 20A, or those of FIG. 21, or have any other desired geometry.

ELECTRIC POWER ASSEMBLY, comprises a 50 kWh or greater DC electric generator, such as those available from Miller Corporation, with high current copper cable 102 to deliver the negative polarity to the interior contact assembly and copper cable 44 for the delivery of the positive polarity to the cathode holder 60 protruding below and outside the base of the vessel, and automatic feeder 45 for the initiation, maintaining and optimization of the electric arc. The automatic feeder 45 has the capability of rotating the copper rod 101 of the cylindrical anode 70 at the speed of 5 r.p.m. in addition to its motions along the rod axis, so as to permit the rotation of the cylindrical anode 70 over the cathode 62, in addition to the motion of the cylindrical anode 70 toward and away from the stationary cathode 62.

The operation of the preferred embodiment of the high pressure PlasmaArcFlow reactor of FIG. 21 is as follows: the cylindrical carbon or coal anode 70 is inserted into its copper holder 99 and placed in the position suitable to initiate the arc; the closed reactor vessel is filled up completely with the liquid waste 38 to be recycled, such as automotive antifreeze waste or engine oil waste or crude oil; the reactor is then primed with gas according to the present invention for the complete removal of atmospheric oxygen in the interior of the vessel; the PlasmaArcFlow and heat utilization pumps are activated; the automatic feeder 45 of the electric arc is initiated at a distance from the equipment or via computer sequence; the cylindrical carbon or coal anode 70 initiates rotation edgewise with respect to the tungsten cathode 62, while advancing also head-on until the electric arc is initiated; as the carbon or coal is consumed by the electric arc at one point of the edge of the cylinder anode 70, the rotation of the latter, plus its micrometric downward motion when needed, permit keeping constant the electric voltage of the arc, thus maintaining constant its gap; the gas is immediately produced following the initiation of the electric arc, jointly with the production of heat in the liquid; operation initiates at atmospheric

internal pressure, and rapidly increases with the production of gas to the preset pressure of the gauge-valve assembly 77; all gas produced in excess of said pre-determined pressure is then permitted to exit the reactor and be pumped into conventional storage tanks.

The high pressure PlasmaArcFlow reactor in the embodiment of FIG. 21 requires the periodic replacement of the cylindrical carbon or coal anode 70 every approximately 8 hours of work for the cylinder dimensions given above. Such replacement can be realized via means for fast removal of the top of the vessel and fast reloading of the new cylinder anode.

To understand the duration of the cylindrical anode, recall that a 3/4" carbon or coal rod is consumed at the rate of about 1/2" per cubic foot. A cylindrical anode with 3/4" thickness, 1' radius and 3' height is the equivalent of 300 linear rods of 3/4" in diameter and 12' length, thus being useful for the production of 7,200 cubic feet of gas which, at the rate of 900 cf/h lasts for 8 continuous working hours, as indicated. Longer durations of the cylindrical anode can be easily accommodated by increasing its radius, or its height or both. A sufficiently larger vessel can, therefore, be designed to work continuously for 24 hours, then halt operation for the rapid replacement of the cylindrical anode, and then resume operations immediately thereafter.

The high pressure PlasmaArcFlow reactor of FIG. 21 has an efficiency that is dramatically greater than that of low pressure reactors, because the production of the gas in the electrodes gap displaces the liquid waste to be recycled, as a consequence of which the electric arc occurs for the majority of the time, estimated to be 60%, within the gas produced, rather than within the liquid.

By comparison, when operated at pressures on the order of 200 or 300 psi, the bubbles of gas produced by the electric arc are dramatically reduced in size by at least 99%. Accordingly, the electric arc occurs for the majority of the time within the liquid to be recycled, thus

dramatically increasing the production of gas, with a corresponding dramatic increase in the heat produced.

An alternative embodiment of FIG 21 is one in which the negative polarity of the electric current is delivered via copper bushing sliding on the exterior cylindrical surface of the anode 70 at about 1" distance from its lower edge and positioned as close as possible to the electric arc to minimize losses of electric energy due to the high resistance of carbon. In this alternative embodiment the anode 70 has an outside diameter of 2', and the anode driving assembly drives the copper rod or shaft 101 of the anode 70 and contains an additional means for rotation while advancing. The main advantage of this alternative embodiment is a substantial savings of electric energy. In fact, for the embodiment of FIG. 21 the electric current has to pass through the entire length of the cylindrical anode, with considerable losses due to known resistance of carbon which is about 300 times the resistance of copper. By comparison, the latter embodiment allows the delivery of the current very close to the arc, thus avoiding the preceding waste of electric energy.

Individual substances can be removed from the produced gas via chemical or other means while preserving the remaining structure. An illustration is given by the removal of carbon monoxide from the gas, resulting in a carbon-free version of the gas, which is essentially given by hydrogen. The structure is preserved as proven by measurements of average weight, which is up to 20 a.m.u., which is up to ten times the weight of a conventional hydrogen gas. Accordingly, the new species of hydrogen is preferable over conventional hydrogen in all its fuel applications, with particular reference, but not limited to the use of magnecular hydrogen as a fuel for internal combustion engines and fuel cells. In fact, measurements prove that a given volume of the new species of hydrogen at a given pressure lasts at least ten times longer than the

same volume of conventional hydrogen at the same pressure, while having an increase in energy output in cars or an increase in efficiency in fuel cells of at least 10% due to the reasons indicated above, including the additional energy storage or a better geometric readiness of the gas.

The PlasmaArcFlow reactors depicted in FIGS. 20A-20C and 21 can also be used by replacing the liquid in the vessel with a gas, provided that the equipment is suitably modified to withstand interior gas pressures of at least 10,000 psi. This is readily possible because, for the treatment of gases, there is no need for carbon-based electrodes, which can therefore be nonconsumable such as those made of tungsten. Accordingly, there is no longer any need for the electrodes to penetrate into the vessel, or for the vessel to have an opening for the removal of the gas produced when operating with liquids. As a result, the vessel of FIG. 21 can be completely sealed, thus readily suitable to withstand 10,000 psi of internal pressure or more.

In this latter embodiment the gas with a conventional molecular structure is turned into one with an essentially pure population of the new clusters following the operation of the PlasmaArcFlow reactor for a duration of time dependent on the electric power of the reactor, as well as the gas selected. For instance, 75 kWh DC power unit with an electric arc having 1,500 A and 33 V can create the new clusters in 10 cubic feet of a conventional hydrogen at atmospheric pressure compressed to 10,000 psi in about 15 minutes of operation.

The advantages of the creation of the new clusters in a given gas are evident; and their selection depends on the specific application. For instance, the new clusters are advantageous when the specific application at hand requires an increased atomic weight, or an increased adhesion, or an increased solution within liquids.

One application of particular industrial, consumer and environmental interest is the creation in the PlasmaArcFlow equipment identified above of oxygen with an essentially pure population of the new clusters. Again, this particular form of oxygen is created by using a PlasmaArcFlow reactor modified to withstand at least 10,000 psi, and then continuously recirculating the oxygen through one of the venturies of FIGS. 20A, 20B and 20C operated by a continuous arc between nonconsumable tungsten electrodes with DC 75 kWh electric power, yielding an arc with 1,500 A and 33 V. In this case 100 cubic feet of oxygen can acquire an essentially pure population of the new clusters in about 30 minutes of operation, with evident shorter operating times for bigger electric powers.

The new species of oxygen is important in combustion. As indicated above, the combustion of hydrogen provides an increase of energy output or efficiency of at least 10% as compared to the energy output or efficiency, respectively, of the combustion of conventional hydrogen, resulting in a total increase of 20% of energy output, which is significant and important for the fuel cells industry.

In conclusion, subject to the modifications identified above, PlasmaArcFlow reactors produce an essentially pure population of the new clusters by filling up the vessel either with liquids or with gases. Accordingly, the substance contained in the PlasmaArcFlow reactor shall hereinafter referred to as a "fluid" in its traditional meaning of denoting either a liquid or a gas.

The following experimental evidence establishes the scientific and industrial validity of the present invention and is not meant in any way implicitly or intentionally to restrict the scope of the invention. These experimental results establish the existence of the new clusters in gases, liquids and solids, as well as establish each of their unique features. All experimental verifications have been conducted several times. In the following we outline, for brevity, only

two out of the several verifications available per each individual feature of the new clusters. Further, all tests were conducted at independent laboratories identified below per each test, which laboratory had no affiliation of any type to the inventor and/or any of his associates.

The first experimental detection of the new clusters via GC-MS/IRD occurred at the McClellan Air Force Base in North Highland, California via measurements conducted on a sample of the new gas. The measurements were conducted on an HP GC model 5890, an HP MS model 5972, and an HP IRD model 5965 attached to the GC-MS. In particular, the equipment was set for the analytic method VOC IRMS.M utilizing an HP Ultra 2 column 25 m long with a 0.32 mm ID and a film thickness of 0.52 μm . The analysis was conducted from 40 a.m.u. to 500 a.m.u. The GC-MS/IRD was set at the lowest possible temperature of 10°C; the largest possible feeding line having an ID of 0.5 mm was installed; the feeding line itself was cryogenically cooled; the equipment was set at the longest possible ramp time of 26 minutes; and a linear flow velocity of 50 cm/sec was selected. Background measurements of the instrument were taken prior to any injection of the gas. The instrument was also inspected and approved, confirming the lack of any contaminants.

After waiting for 26 minutes, sixteen large peaks appeared on the MS screen between 40 and 500 a.m.u. as shown in FIG. 1. Each of these sixteen MS peaks resulted to be "unknown", following a computer search of database on all known molecules available at McClellan Air Force Base, as shown in FIG. 2. No identifiable CO₂ peak was detected at all in the MS spectrum between 40 and 500 a.m.u., contrary to the known presence of such a conventional molecule in the gas.

Upon the completion of the MS measurements, exactly the same range of 40 to 500 a.m.u. was subjected to IR detection. None of the sixteen peaks had any infrared signature at all,

as shown in FIG. 3. Further, the IR scan for these MS peaks shows only a peak belonging to CO₂ with very small traces of other substances. Note that the IR signature of the other components, such as CO or O₂ are not detectable in this test because their atomic weights are below the left margin of the scan. In addition, the IR peak of CO₂ is itself different from that of the molecule CO₂ as shown in FIG. 4. Note that the computer interprets the IR signature as that belonging to CO which is evidently erroneous because CO is outside of the selected range of a.m.u. units. All remaining small peaks of the IR scan also resulted to be "unknown" following a computer search in the database of IR signatures of all known molecules available at the McClellan Air Force Base, as illustrated in FIG. 5. Following the removal of gas from the GC-MS/IRD and conventional flushing, anomalous peaks were detected in the background similar to those of FIG. 1. Following a weekend long bakeout, the background, as shown in Fig. 6, was still anomalous, since the known correct version has a slope opposite to that of FIG. 6. The correct background was regained only after flushing the instrument with an inert gas at very high temperature.

The tests performed at McClellan Air Force Base were repeated on exactly the same sample of the gas in the same pressure bottle at the Pinellas County Forensic Laboratory in Largo, Florida. The equipment used in the latter laboratory included an HP GC model 5890 Series II, an HP MS model 5970 and an HP IRD model 5965B attached to the GC-MS. These tests confirmed in their entirety the results previously obtained at McClellan Air Force Base, as shown in the scan of FIGS. 7-11.

The gas was subjected to two MS tests reproduced in FIGS. 7 and 8, which occurred at about 30 minutes difference in time. As one can see, the peaks in FIG. 8 are macroscopically different from the peaks of FIG. 7 detected on the same sample just 30 minutes

earlier. This difference confirmed the prediction that, when colliding the new clusters break down into fragments, which then recombine with other molecules, atoms, and/or other clusters to form new clusters. Similarly, the mutation of the new clusters can occur via the accretion of another atom, dimer, molecule, or cluster, without breaking.

In fact, as shown by comparing the scans of FIGS. 7 and 8: the peak at 286 a.m.u. of the former becoming 287 a.m.u. in the latter, thus establishing the accretion of one hydrogen atom; the peak at 302 a.m.u. in the former becomes one at 319 a.m.u. in the latter, thus establishing the accretion of the H-O dimer; the peak at 328 a.m.u. in the former becomes 334 a.m.u. in the latter, thus establishing the accretion of one O₂ molecule; the peak at 299 a.m.u. in the former becomes 297 a.m.u. in the latter, thus exhibiting the loss of one H₂ molecule; etc. These features have been confirmed by all subsequent GC-MS/IRD scans on the gas.

FIG. 9 depicts the complete failure by the GC-MS/IRD to identify the peaks of FIGS. 7 and 8 following a search in the database among all known molecules. FIG. 10 confirms in full the mutated IR signature of CO₂ previously identified at the McClellan Air Force Base, shown in FIG. 4, including the presence of two new peaks, with the sole difference that, this time, the computer correctly identifies the signature as that of carbon dioxide. FIG. 11 presents the background of the instrument after routine flushing with an inert gas which background, as one can see, essentially preserves the peaks of the tests, thus confirming the unique adhesion of the new clusters to the instrument walls.

A property important for the correct interpretation of the above experimental evidence is that the CO₂ peak detected in the IR scans of FIGS. 4 and 10 does not correspond to any peak in the MS of FIGS. 1, 7 and 8. More specifically, there is no MS peak in the scans of FIGS. 1, 7, and 8 identifying the CO₂ molecule. Moreover, the IR scan was done for the entire range of 40

to 500 a.m.u., thus establishing that said IR peak is the sole conventional constituent in a macroscopic percentage of all sixteen peaks in the MS, namely, the single constituent identified in the IRD is a constituent of all sixteen MS peaks of FIG. 1 or of the single large peak of FIGS. 7 and 8. It should also be noted that, as recalled earlier, the IR only detects the dimer O-C and not the complete molecule O-C-O. Therefore, the detected peak in the IR of FIGS. 3 and 10 is not sufficient to establish the presence of the complete molecule CO₂ unless the latter is independently identified in the MS. The MS scan does not identify any peak for the CO₂ molecule, as indicated above. Nevertheless, the presence in all sixteen MS peaks of FIG. 1 of complete molecules CO₂ cannot be ruled out. Therefore, the only possible conclusion is that the sixteen peaks of FIG. 1 represent clusters composed by O-C dimers and O-C-O molecules, plus other dimers, and/or other molecules, and/or atoms with atomic weight smaller than 40 a.m.u.

The large differences of MS peaks in the above two tests of exactly the same gas in exactly the same range from 40 to 500 a.m.u. although done with two different GC-MS/IRD illustrates the importance of having a ramp time of the order of 26 minutes. In fact, sixteen different peaks appeared in the MS scan following a ramp time of 26 minutes, as illustrated by FIG. 1, while all these peaks collapsed into one single peak in the MS scan of FIGS. 7 and 8, because the latter were done with a ramp time of about one minute. Therefore, the collapse of the sixteen peaks of FIG. 1 into the single large peak of FIGS. 7 and 8 is not a feature of the new clusters, but rather it is due to the insufficient ramp time of the latter instrument.

The sixteen peaks in the MS of FIG. 1, all in macroscopic percentages, all unidentified by the computer search, none of which possesses an IR signature, establish beyond any possible doubt that the chemical composition of the gas in the range 40 to 500 a.m.u. is totally, rather than substantially, composed by a new chemical species.

Note that the very existence in the new gas of fully identifiable peaks with atomic weight of the order of several hundreds a.m.u. is direct evidence of a new chemical species. In fact, the gas is produced from a plasma at about 10,000 °F of mostly ionized atoms of hydrogen, carbon and oxygen. When produced from distilled water via a submerged electric arc between consumable pure carbon electrodes, as it is the case for the gas of the tests here considered, said plasma is composed of 50% hydrogen atoms, 25% carbon atoms and 25% oxygen atoms. Consequently, the plasma should produce a gas consisting of 50% hydrogen and 50% CO with traces of O₂, H₂O and CO₂. In fact, all possible hydrocarbons must be excluded because they could not possibly survive at the 10,000 °F of the submerged electric arc, assuming that they could be formed at said temperature. In conclusion, which should exist in the gas of the tests here considered, should be the CO₂ molecule with 44 a.m.u. Therefore, the experimental evidence here presented of MS peaks in macroscopic percentages with several hundreds of a.m.u., as established by the measurements of FIGS. 1, 7 and 8, provide incontrovertible evidence of the new chemical species capable of constructing said heavy peaks via the use of lighter constituents.

The same presence of large peaks all the way to 500 a.m.u. establishes the increase in atomic density. In fact, the form of gas composed of 50% H₂ and 50% CO should have the average density of 15 a.m.u. while densities up to 200 a.m.u. have been measured in the laboratory for this gas.

Several additional embodiments have been constructed and experiments have been conducted to create and detect the new clusters in liquids. As indicated earlier, their creation of clusters in liquids is easier than that in gases due to the dramatic reduction of rotational, vibrational and other motions in liquids as compared to those in gases.

Even though the creation of detectable new clusters in liquid is easier than that in gases, the detection of liquid clusters is considerably more difficult than that of gas clusters because the virtual totality of analytic equipment available in existing laboratories is given by LC-MS without any UVD, and with small feed lines. Moreover, the available LC-MS operate at very high column temperatures, such as of the order of 250°C, which temperatures are generally greater than the Curie Temperature of the liquid clusters themselves. As a result, the very injection of the liquid in the instrument generally destroys all entities to be detected, resulting in a generally erroneous perception of a completely conventional molecular composition without real scientific evidence.

In fact, conventional molecular interpretations are in dramatic disagreement with a number of other experimental data, thus having no scientific credibility. As a specific illustration, the creation of the new chemical species of clusters in oils implies: 1) a dramatic transition from complete transparency to its complete absence; 2) a dramatic increase in specific density; 3) a dramatic change in adhesion, chemical reactions, surface tension, and other features.

Ironically, currently used feeding lines, syringes and methods do not even permit the injection of the new liquid clusters in the LC-MS, let alone allow their detection. This is because, unlike the case of gases, the new liquid clusters can be so large as to be visible to the naked eye, thus being much larger than the sectional area of feeding lines currently used for conventional liquids. Even when feeding lines have the same dimension as those of liquid clusters, the latter cannot freely propagate in them due to their anomalous adhesion which, in certain cases required the use of strong acids for their removal. Under these unfavorable conditions, one can at best expect that only small fragments of the new liquid clusters can enter

conventional LC-MS, and positively no claim of measurements can be ventured for clusters visible to the naked eye with dimensions greater than the capabilities of feeding lines, syringes and other injection instruments.

The above occurrences confirm the general inability of currently available LC-MS to detect liquid the new clusters, and the need stressed earlier of new equipment and procedures specifically conceived to detect the new chemical species. In fact, the new liquid clusters are fully identified via the use of the appropriate LC-MS instrument equipped with the UVD, and verifying the other requirements indicated earlier, such as column temperature below the Curie Temperature of the species to be detected, use of very large feeding lines, ramp times of the order of 25 minutes or more, etc.

The experimental evidence establishing the existence of liquid the new clusters and their unique properties is summarized below. A number of samples of fragrance oils were obtained from a distributor of such oils. The samples were all perfectly transparent and each had a known viscosity. Fifty cc of each of these oils were placed in individual glass containers. Several alnico permanent magnets with 12,000 G and dimension 1/2" by 1" by 2" were used. A polarity of said permanent magnets was then immersed in the jars filled with said fragrance oils, while the other polarity was outside the liquid.

After two days, a visible darkening and increase in viscosity of the oils occurred which varied from oil to oil. Both the darkening and the viscosity increased progressively in subsequent days, to reach in certain cases a dark brown color completely opaque to light and the loss of fluidity. In certain samples, the complete loss of transparency was reached following intermediate stages with completely opaque granules initially visible with a microscope and then

visible to the naked eyes, as established by FIGS. 12A, 12B, 13A and 13B, until the granular structure was lost in favor of a completely homogeneous opaque liquid.

These visible effects can only be of magnetic origin because the fragrance oils were subjected to no outside action other than the application of the indicated magnetic fields. In particular, the permanent magnets were sterilized prior to their immersion in the oils and the samples were maintained undisturbed at room temperature.

Particularly important for the above magnetic polarization is the presence in the liquid considered of dimers such as H-O, H-C, etc.

The alteration of the structure of fragrance oils was confirmed by two photographs under the microscope taken in two different laboratories, as it is the case for all experimental evidence presented herein. FIG. 12A was taken at a magnification of 10X, and FIG. 12B was taken at a magnification of 100X. Both FIGS. 12A and 12B refer to the fragrance oil identified under the code "ING258IN, Text 2" and subjected to the magnetic field described above. As one can see, FIG. 12A establishes that, under the indicated magnetic treatment, the oil has acquired a kind of "brick layering structure" which is visible under only 10X magnification. The same "brick layering structure" is confirmed by FIG. 12B under magnification 100X.

Note that the new liquid clusters are not constituted by the individual "bricks," but rather by the opaque substance which interlocks said "bricks," since the latter preserves the original transparency. Inspection of the photographs shows a variety of sizes of the new clusters, thus establishing their lack of unique atomic weight for any given oil.

The photographs of FIGS. 13A and 13B were taken at the Marine Science Laboratory of the University of South Florida in St. Petersburg. FIGS. 13A and 13B also refer to magnifications 10X and 100X, respectively, although for a different fragrance oil identified

under the code name of "Mixture 2", which oil was subjected to the same magnetic field indicated above. Despite the different chemical structure of the latter oil, the results were essentially the same as those of the preceding oil, namely, there was the formation in a few days of very small granules only visible with the microscope, and their progressive accretion into opaque granules visible to the naked eye suspended in a transparent medium, until the achievement of a homogeneous and opaque liquid with high viscosity.

As shown in FIG. 13A, following two days of exposure to a 12,000 G magnetic field, the molecules of said fragrance oil bonded together into rather large clusters with an atomic weight estimated to be well in excess of 10,000 a.m.u.

The existence of the new clusters in liquids also results in alterations, called "mutations", of physical characteristics, such as increases in specific density and viscosity. It is evident that the new clusters imply an evident reduction of intermolecular distances, with a consequential increase in the number of ordinary molecules per unit volume. The consequential increase in specific weight then implies an increase in viscosity. These physical changes are large macroscopic alterations, which are often visible to the naked eye.

Various measurements of specific density and viscosity were conducted at the analytic laboratory U. S. Testing Company, Inc. of Fairfield, New Jersey. The measurements were conducted on ordinary tap water, fragrance oils and engine oils subjected to the indicated magnetic field. Samples were prepared by mixing conventional tap water and one fragrant oil, and then subjecting the mixture to the rather weak field of a permanent magnet with 200 G. After treatment for about two days, all samples were stable without any measurable changes detected over a period of about one full year. Further, the samples remained unchanged upon freezing and subsequent thawing.

Ordinary untreated tap water was denoted Sample 1; Sample 2 was ordinary tap water magnetically treated for about 5 minutes; Samples 3 and 4 were ordinary tap water magnetically treated with equipment different than that used to treat Sample 2; Fragrance 5 was an untreated fragrance oil identified under the code name "APC Fragrance"; Mixture 6 was fragrance oil "APC Fragrance" mixed 50-50 with tap water and thereafter magnetically treated for about 5 minutes; Mixtures 7 and 8 were the same Mixture 6 except that they were magnetically treated with equipment different than that used to treat Mixture 6. Fragrance 17 was a magnetically treated oil identified under the code name "Air Freshener 1"; Mixture 19 was Fragrance 17 mixed with Treated Water 16 and magnetically treated for 5 minutes. All measurements were performed to an accuracy of the fourth digit. Accordingly, the numerical results of the first two digits are accurate.

As expected, in the transition from Sample 1 (untreated water) to Sample 2 (magnetically treated water) there was an increase in the specific density in the macroscopic amount of 0.86%. As is well known, fragrance oils are generally lighter than water, i.e., the specific density of the untreated Fragrance 5 is less than that of untreated water in Sample 1. However, the specific density of the treated mixture of "APC fragrance 1" with tap water, Sample 6, resulted in a specific density 0.49% greater than that of water, while, for a conventional molecular structure, the specific weight of said mixture should have been in between the specific weight of water and that of the oil. Similarly, Mixture 6 was 1.86% heavier than the untreated tap water it contained; Mixture 7 was 1.60% heavier than untreated tap water; Mixture 8 was 0.99% heavier than untreated tap water; Sample 16 was 0.89% heavier than untreated tap water; Mixture 18 was 0.99% heavier than untreated tap water; and Mixture 19 was 1.26% heavier than untreated tap water.

The viscosity of treated liquids was also measured at the analytic laboratory U. S. Testing Company, Inc. of Fairfield, New Jersey, and was dramatically greater than the viscosity of untreated liquid, thus confirming in full the visual observations indicated earlier. Ordinary engine oils are particularly suited for magnetic polarization because their increase in viscosity with a corresponding change in the visual appearance of color, texture, opacity, etc. The engine oil selected for the viscosity measurements was a sample of ordinarily available 30-40 Castrol Motor Oil, which was subjected to two different types of magnetic polarizations called of Type A and B, and referred to increasing occlusion of atmospheric gases. All treatments were done at ordinary conditions of atmospheric temperature and pressure without any chemical additives. Measurements conducted at the indicated analytic laboratory established a dramatic 44.5% increase in the viscosity in the oil with magnetic treatment A, exposure of the liquid to North polarity, as compared to the viscosity of the untreated oil, while measurements on the oil with magnetic treatment B, exposure of the liquid to South polarity, established the dramatic increase of 51.2% in viscosity.

The above indicated measurements also established other unique chemical properties of the new liquid clusters. The most visible one was the malfunctioning of all equipment following their exposure to treated liquids and their standard cleaning used for all conventional liquids. Following contact with liquid clusters, the instruments were cleaned with very strong acids at high temperature, after which conventional working conditions were regained. The malfunction was evidently caused by the unique adhesion of the new clusters, which, for the case of liquids is so dramatic as to require high temperatures for their removal.

The above tests also confirmed the unique thermochemical behavior of liquid the new clusters. In fact, the action of acids on treated liquids was dramatically different both in energy

release as well as color and appearance as compared to the action of the same acid on untreated liquid.

Finally, the above tests also established the unique penetration characteristics of treated liquid through other substances.

Other examples of an essentially pure population of the new clusters in liquid have been obtained with the PlasmaArcFlow Reactor as described above with a DC electric arc of 1000 amps and 30 volts. Three different examples of essentially pure populations of the new clusters were obtained. The first species was obtained by flowing antifreeze through the electric arc for approximately two (2) hours. The second species was obtained by flowing engine oil through the electric arc for approximately two (2) hours. The third species was obtained by mixing equal volumes of the above two species, which do not normally mix, yet these substances mixed after the treatment indicated above and bonded in such a fashion to be so dense as to be non-pumpable.

As indicated earlier, the new clusters are also present in solids. In particular, all treated liquids preserve the new species when frozen and then liquefied again. In fact, all unique characteristics were recovered in the return to the liquid state, thus confirming the preservation of clusters in the transition from liquid to solid state, as readily expected, since such a transition implies a decrease of Brownian and other motions with a consequential increase in stability of the clusters. Therefore, the experimental evidence on the existence of the new clusters in gases and liquids is direct experimental evidence of their existence in solids, since the latter can be merely obtained by freezing the former.

The first mass spectrographic experimental evidence on the new clusters in liquids was established at the Tekmar-Dohrmann Corporation (TDC) in Cincinnati, Ohio, by operating a

Tekmar 7000 HT Static Headspacer Autosampler equipped with a Flame Ionization Detector (FID). The measurements were done on: Sample 1, pure magnetically untreated "Fragrance Oil"; Sample 2, magnetically treated tap water; and Sample 3, a magnetically treated mixture of the preceding two liquids.

Recall that the new clusters in liquids can have very large atomic weights all the way to 10,000 a.m.u. and more, thus requiring instruments equipped with very large feeding lines, and capable of scanning all the way to very high weights. These and other features were absent in the indicated Tekmar instrument. Despite that, the TDC tests constitute direct mass spectroscopic experimental evidence of the existence of the new clusters in liquids, including direct experimental evidence of water clusters.

FIG. 14 reproduces the TDC scan of magnetically untreated fragrance oil "Mixture 2". The default report of the scan, not shown, shows the oil to be composed of the following three primary molecules characterized by: Peak 1 at 6.448 min and 22.96%; Peak 2 at 7.378 min and 0.02%; and Peak 3 at 32.808 min and 68%. It should be noted that this is the chemical structure of the fragrance oil of FIGS. 13A - 13B.

FIG. 15 shows spectroscopic experimental evidence of the new clusters in treated tap water characterized by the large unknown peak at 25.763 min whose default report, not shown, and 64.24%. The field of the 12,000 G used for the treatment of water cannot possibly break down the water molecule. Therefore, the cluster here referred to is solely composed of water molecules without any appreciable percentage of dimers and/or of isolated atoms.

FIG. 16 reproduces experimental evidence of the new clusters in a treated 50-50 mixture of tap water and fragrance oil "Mixture 2". The primary stable clusters detected by the instruments according to the default report, not shown, are: a first peak at 6.449 min for 5.33%; a

second peak at 7.373 min for 18.74%; a third peak listed by the equipment as unknown 1 at 26.272 min for 1.75%; a fourth peak at 26.347 for 1.16%; a fifth peak listed by the equipment as unknown 2 at 31.491 for 0.45%; and a sixth peak at 32.758 min for 68.71%. Comparison of the above scan with the separate scans of tap water and the fragrance oil "Mixture 2" establishes beyond any possible doubt the creation of liquid the new_ clusters. Since the intensity of the magnetic field here used was absolutely insufficient to break down the molecules of water and of the fragrance oil, the only possible constituents of the new peaks are conventional molecules. Therefore, the new clusters characterized by the unknown peaks of this scan are given by water molecules plus oil molecules 1, 2 and 3 of FIG. 14.

Note also that in FIG. 14 the percentage of Peak 1 is 148 times greater than that of Peak 2. In the transition to the treated case, Peak 2 becomes dominant over Peak 1, the percentage of the former being 3.51 times that of the latter. This is evidence of the capability of the molecule represented by Peak 1 to acquire more magnetic polarizations than that of Peak 2.

Numerous additional tests were conducted at the TDC laboratory, not reported here for brevity. These tests confirmed all other features of liquid the new clusters, such as their mutation, i.e., the variation in time of their atomic weight or percentage, and their unique adhesion. In fact, all blanks of the Tekmar instrument following measurements of liquid clusters were dramatically different than the blanks prior to the injection of magnetically polarized liquids. Moreover, the peaks of the blanks were essentially those of the new clusters, rather than of conventional molecules. As a matter of fact, one way to confirm the detection of a cluster during a test is by verifying that such a cluster does indeed persist in the blank following the completion of the test, a procedure which is important for this invention but completely senseless for the conventional chemical species of molecules. In any case, as it was the case for gas the

new clusters, conventional blanks are readily obtained by flushing the instrument with a suitable inert substance at high temperature.

Comprehensive tests via a very modern LC-MS equipped with UVD were conducted on magnetically treated liquids at the Department of Chemistry of Florida International University in Miami (FIU). These tests were conducted under a number of technical characterizations specifically selected to detect the new clusters, such as:

- 1) Total Ion Chromatogram (TIC), which was operated under the positive ion atmospheric pressure electrospray ionization (ESI+) mode;
- 2) Integrated TIC with retention times and areas for the most abundant peaks;
- 3) Raw mass spectra for all peaks identified in item 2;
- 4) HPLC chromatograms collected at fixed wavelength of 254 nm;
- 5) UV-visible spectra from the HPLC diode array detector from 230 to 700 nm.

The FIU tests were conducted on the following samples:

- A) The untreated, fully transparent fragrance oil "ING258IN Test 2";
- B) The treated "ING258IN Test 2" with 10% Dipropylene Glycol (DPG);
- C) The bottom layer of the preceding sample;
- D) The treated mixture 4% fragrance oil "ING258IN Test 2", 0.4% DPG and 95% tap water; and
- E) The visible dark clusters in the preceding sample as seen under the microscope and reproduced in FIGS. 18A-18B.

To avoid a prohibitive length of these specifications, only representative scans of the FIU tests are reproduced below. In particular, FIG. 17 reproduces the scan of the untreated fragrance

oil "ING258IN Test 2" of FIGS. 12A -12B. FIG. 18 reproduces the scan of the treated oil "ING258IN Test 2" with 10% DPG. FIG. 19 reproduces the scan of the dark liquid at the bottom of the sample tested with the scan of FIG. 18. A large variety of additional scans are omitted for brevity.

Inspection of the scans of FIGS. 17 - 19, as well as, of the numerous others obtained at FIU establishes beyond any possible doubt the existence of the new clusters in liquids characterized by various unknown MS peaks, none of which has any UV signature other than that of the molecular constituents, one of which is represented by the large unknown peak in FIGS. 18 and 19. Note a corresponding decrease of the peaks representing conventional molecules as compared to the value of FIG. 17. The latter occurrence is necessary for the correct detection of the new clusters because molecules are removed in their conventionally detected state when turned as constituents of the new clusters. The same FIU tests confirmed all other features of liquid the new clusters, such as their mutation, unique adhesion and unique penetration.

It should be noted that the treated liquids of the above TDC and FIU tests do not constitute an essentially pure population of the new chemical species of clusters, as it is the case of the scan of FIG. 1 for gases. This is due to the presence in macroscopic percentages of conventional molecules, which must be evidently absent to have an essentially pure population of clusters. This occurrence was also expected and it is due to the insufficient value 12,000 G of the magnetic field used in the treatment of the liquids. In fact, additional tests, not reported here for brevity, conducted by exposing the same mixture of tap water and fragrance oils to extremely strong magnetic fields, on the order of 10^{16} Gauss at molecular distances, have proved the complete disappearance of molecules and the sole composition of the mixture as being that of an

essentially pure population of the new clusters, exactly as it is the case for gases. The essentially pure population of the new liquid clusters is generally obtained by exposing the liquids to electric discharges which can, this time, break down conventional liquid molecules into their dimers and individual atoms. As a result, for the case of an essentially pure population, the new liquid clusters are generally constituted by molecules, dimers and individual atoms, as it was the case for gases and in accordance with the definition of the new clusters.

The new gaseous, liquid or solid clusters have truly novel and important, industrial, commercial, and consumer applications in a variety of fields, including, but not limiting to, fuel industry, fragrance industry, paint industry, adhesive industry, medical industry, etc., among which we note:

- 1) Regarding the fuel industry, truly new fuels composed of an essentially pure population of the new clusters are now industrially feasible to produce on a mass scale. The new fuels possess dramatic increases of energy content; surpass all EPA requirements without a catalytic converter; emit during combustion no carcinogenic, carbon monoxide or other toxic substances; reduce the emission of carbon dioxide in gasoline combustion by about 50%; emit in the exhaust up to 14% breathable oxygen; are dramatically safer than gasoline; and are cost competitive with respect to the latter. In particular, the new fuels are produced from the processing of liquid waste by the PlasmaArcFlow reactors of FIGS. 20 and 21, although the best possible liquid is crude oil. Rather than turning crude oil into the polluting and expensive gasoline, this invention permits the processing of crude oil into a new fuel, which is cleaner, cheaper and safer than gasoline. In view of all these features, it is a truism to state that the new chemical species of this invention can produce a revolution in the fuel industries to the benefit of the environment and the consumer.

2) Regarding the fragrance industry, the new chemical species of this invention permits the industrial production and consumer use of basically new perfumes, which are water based, rather than currently available perfumes, which are alcohol, based. The former perfumes have dramatic advantages over the latter, such as: alcohol ages the human skin, while water does not; water based perfumes evaporate much slower than their alcohol based counterpart, thus lasting longer; perfumes comprised of the present invention penetrates the human skin much deeper than the alcohol based perfumes, thus providing a longer lasting and individualized fragrance. In particular, water based perfumes can be used for the first time by those whose religion prohibits the use of alcohol based perfumes.

3) Regarding the paint industry, the new chemical species of this invention permits the industrial production and commercial or consumer usage of basically new paints, which adhere to walls dramatically, more than conventional paints.

4) Regarding the adhesive industry, the new chemical species of this invention permits the industrial production and use of basically a new adhesive with adhesion dramatically greater than that of currently available adhesives. In particular, different adhesives are currently needed for different substances, such as wood, ceramics, metals, etc. Due to the universality of their unique adhesion, the new clusters permit the elimination of these differences and the use of only one adhesive for all possible substances.

5) Regarding the medical industry, the new chemical species of this invention permits numerous new applications. For instance, this invention permits new methods for delivering drugs consisting of their penetration through the skin, by therefore eliminating in appropriate cases the delivery of drugs via injection. This new method is permitted by the unique penetration of the new species through other substances due to a combination of factors,

such as the reduction of the average size. The advantage of this new method of drug delivery is evident, for instance, in the case of infected wounds where the use of conventional drugs remains in the surface of the human body, thus requiring injection of the drug and its propagation throughout the entire human body, at times with well known side effects, just to reach an infection localized in one small part of the body. By comparison, drugs with magnecular structure can easily penetrate throughout the entire infected area and below, precisely in view of the indicated magnetic induction and related unique penetration. Basically new drugs are also permitted by the unique features of the new clusters, such as its unique release of heat, which can be used for new lotions usable in massages, or other treatments. Yet another medical application is the capability to preserve indefinitely the sterilization of surgical instruments when immersed within treated water, as compared to the current exposure of said surgical instruments to air, and the consequential loss of their sterile character prior to their use in surgeries. In fact, treated water is completely sterilized and remains so on an indefinite basis, since it does not permit the reproduction of bacteria or other living organisms due to its structural difference from the water molecules needed for such reproduction.

It should however be stressed that each and every one of the above novel industrial, commercial or consumer applications crucially depends on the technological capability to reach an essentially pure population of the new clusters because none of the indicated new applications is meaningful when only traces of the new clusters occur.

The invention is clearly new and useful. Moreover, it was not obvious to those of ordinary skill in this art at the time it was made, in view of the prior art considered as a whole as required by law.

It will thus be seen that the unique properties and benefits set forth above, and those made apparent from the foregoing description, are efficiently attained. It is intended that all matters contained in the foregoing description or shown in the accompanying drawings shall be interpreted as illustrative and not in the limiting sense.

It is also to be understood that the following claims are intended to cover all of the generic and specific features of the invention herein described, and all statements of the scope of the invention which, as a matter of language, might be said to fall therebetween.

Now that the invention has been described,